

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

NASA ADVISORY COUNCIL

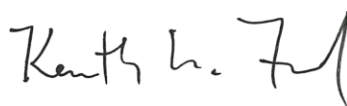
July 16, 2009

Holiday Inn Capital – Columbia Ballroom
550 C Street SW, Washington, DC

MEETING REPORT



Ms. Marguerite Broadwell
Executive Director



Dr. Kenneth M. Ford
Chair

Report submitted by:
Mark Bernstein
Harris IT Services

NASA ADVISORY COUNCIL MEETING

AGENDA

Thursday, July 16, 2009

8:00 – 8:15 am	Opening Remarks	Dr. Kenneth Ford
8:15 – 9:00 am	NASA Administrator	Mr. Chris Scolese Acting Administrator
9:00 – 9:15 am	U.S. Human Space Flight Plans Committee	Mr. Norm Augustine
9:15 – 9:45 am	<i>“Rationale and Goals of the U.S. Civil Space Program”</i>	Gen. Lester Lyles
10:00 – 11:00 am	Exploration Committee	Gen. J. Abrahamson
11:00 – noon	Science Committee	Dr. Jack Burns
12:20 – 1:05 pm	Audit and Finance Committee	Mr. Ted McPherson
1:05 -- 2:05 pm	Space Operations Committee	Col. Eileen Collins
2:05 – 2:50 pm	Aeronautics Committee	Gen. Lester Lyles
2:50 – 3:30 pm	Human Capital Committee	Dr. Gerald Kulcinski
3:30 – 3:45 pm	Final Comments / Adjourn	Dr. Kenneth Ford

INDEX

Call to Order <i>Dr. Kenneth Ford</i>	4
NASA (Acting) Administrator's Report <i>Mr. Chris Scolese</i>	4
National Academies Study: <i>Rationale and Goals of the U.S. Civil Space</i> <i>Gen. Lester Lyles</i>	6
Exploration and ad hoc Biomedical Committees <i>Gen. James Abrahamson</i>	7
Science Committee <i>Dr. Jack Burns</i>	8
Human Capital Committee <i>Dr. Gerald Kulcinski</i>	11
Review of U.S. Human Space Flight Plans Committee <i>Mr. Norman Augustine</i>	13
Audit and Finance Committee <i>Mr. Ted McPherson</i>	15
Space Operations Committee <i>Col. Eileen Collins</i>	17
Aeronautics Committee <i>Dr. Raymond Colladay</i>	19
Meeting close <i>Dr. Kenneth Ford</i>	20
Appendices	
Appendix A: NASA Advisory Council Attendance Roster	21
Appendix B: Meeting Attendees	23

Thursday, July 16, 2009

The meeting was called to order at 8:04 a.m.

Call to Order

Dr. Kenneth Ford, Chair

Dr. Kenneth Ford noted that the NASA Advisory Council [NAC] had completed two productive days of fact finding. In addition to hearing from each of the six committees today, the Council would hear from the Acting NASA Administrator, from Les Lyles on the National Academies report on the Rationale and Goals of the U.S. Civil Space Program, and from Norm Augustine on his U.S. Human Space Flight Plans Committee.

Ms. Marguerite Broadwell, executive director, reminded all present that this was a public meeting, held under the auspices of the Federal Advisory Committee Act. She noted that, under federal ethics standards, any board member who faced a potential conflict of interest should recuse themselves from the discussion. While the meeting was open to the public, she requested that audience members not interrupt the speakers and there would be a time at the end of the meeting for comments. She noted that all of the presentations from the meeting would be posted on the NAC website:

www.nasa.gov/NAC.

* * *

NASA Administrator's Report

Mr. Chris Scolese

Acting Administrator

Mr. Chris Scolese said that he would present a broad summary of NASA's recent activities. Mr. Scolese noted yesterday's successful space shuttle launch. He observed that today's date – July 16, 2009 – was the 40th anniversary of the Apollo 11 launch, an anniversary that had sparked considerable interest. This anniversary, he said, was a reminder of what a grand challenge space presented. He noted that space flight had produced unforeseen results; among them, the iconic image of Earth taken from Apollo 8, which had widely changed people's perception of the planet. Then, as now, he added, the space program was more than a venture into space; it was also an effort to develop greater space-based capabilities for worldwide communications, to develop means to track weather from space, and other purposes.

Mr. Scolese presented information on the NASA budget, which, he noted, had declined over time as a percentage of GDP. He presented the FY10 budget request. This request, he said, maintained a commitment to human exploration of space; contained an expanded commitment to global climate change and green aviation, and provided for the safe "fly out" of the International Space Station [ISS].

Mr. Scolese identified challenges, including safely completing the space shuttle manifest and managing the workforce transition; utilization of the ISS post-2016; better management of cost, schedule and performance; challenges with the launch manifest; and the need for new technology investments. Reporting on the first two challenges, Mr. Scolese said that the next ISS mission will install the Kibo laboratory – subsequent to this accomplishment, the station's appearance will not greatly change. The recent upgrades to the ISS have also enabled the crew capacity to double to a crew of 6.

Mr. Scolese addressed five ways that NASA is improving cost, schedule and technical performance. First was the need to build a broader understanding of NASA program and project risk. NASA does not buy off-the-shelf items; rather, every mission requires new capabilities. The agency, he said, has not done a sufficient job of explaining to the public and to agency stakeholders how when one works with such uncertainties, difficulties are inherent.

Second, relative to monitoring performance, he said NASA had initiated a more in-depth monitoring and tracking system, including monthly reviews that looked at agency performance and directorate performance, with quarterly reviews of a mission set. The review included attention to budget and technical issues so these could be promptly addressed. If there was evidence that a Center lacked necessary resources, then this was also addressed. Standing review boards have been established on all projects and are undertaken by experts not associated with the project. Their purpose, he said, was to “dive deep” into project performance to see if what was planned was being achieved.

Third, NASA had instituted a program of joint confidence levels, which are a probabilistic estimate of cost and schedule that takes plans and the uncertainties associated with those plans – funding, technology and others – into consideration. Fourth, he said, NASA was working with the National Research Council to develop better early cost estimates. Last, NASA was working with its stakeholders on the creation of stable requirements. Mr. Scolese said the “poster child” for demonstrating the need for these improvements is the Mars Science Laboratory [MSL]. MSL had been recommended to NASA as a \$600 million mission; by the time the mission’s requirements were fully scoped, it had grown to a \$1.6 billion mission. This, he said, was why NASA needed to work with all its stakeholders as early as possible.

Gen. Les Lyles said the points raised by Mr. Scolese had analogs at the Department of Defense [DoD]. He hoped a dialog on this could occur so that best practices and lessons learned could be shared; he added that DoD and NASA had a largely common industrial base. Mr. Scolese welcomed this suggestion.

Regarding the budget, Mr. Scolese presented a chart showing mission directorate budget histories. The chart demonstrated the instability of NASA funding and the consequential difficulty in planning.

Mr. Scolese addressed the challenges with the NASA launch manifest, noting the complications that are precipitated by the phasing out of the Delta-IIs. With the absence of medium-sized launch vehicles, NASA’s launch capacity was bimodal – large or small. The larger vehicles cost more; while the small vehicles cost less, but they carry a smaller payload. If this meant additional launches were required, then no savings might be achieved.

Expanding upon the Agency’s need for new technology investments, Mr. Scolese stated that technology investment had suffered in the past decade, during which time it had been pursued only in a mission-focused manner rather than in a broad way.

On recent accomplishments, Mr. Scolese gave examples from each of NASA’s mission directorates. Regarding the Hubble Space Telescope (Hubble) servicing mission (a joint effort between the science and space operations mission directorates), he said the images coming back from Hubble were everything that had been expected. He called attention to the importance of the Hubble servicing missions – Hubble’s early problems were well known; without the shuttle and without astronauts, the mission could not have been turned into a success. In other activities, he said, NASA was developing better ways to predict cyclones in the Pacific; and NASA satellites were detailing the shrinking of arctic sea ice.

Mr. Scolese gave a brief status report on the launch of Solar Terrestrial Relations Observatory [STEREO]. This will provide a totally different view of the sun, which will permit a better understanding of how best to send crews beyond Low-Earth Orbit [LEO]. He presented brief reports on the Messenger fly-bys of Mercury; Mars Phoenix; Cassini – which has captured Titan’s changing lakes; the Fermi discoveries; Kepler’s work at finding earth-like planets; and NASA MQ-9, the Western forest fire mission, which helps determine priorities for fighting fires.

Mr. Scolese emphasized two points in his summary. He first quoted the NAC Chairman, Dr. Kenneth Ford, “in 500 years... the accomplishments of this Agency of the U.S. Government are among the few human activities that will be looked upon with admiration and ...awe.” He balanced this with a conclusion from the NASA Aerospace Safety Advisory Panel, citing “the top priority of this Agency is the need to have and maintain a stable and sufficient budget that allows NASA to safely execute an integrated space program that follows the Administration’s and Congress’ national space objectives.”

Col. Eileen Collins said she had read about a possible resurrection of the National Space Council. Did Mr. Scolese have a perspective on this? Mr. Scolese noted that discussion was taking place; on balance, he said, he thought the body probably would be reconstituted. He stressed, however, that he did not think NASA needed another external body giving it direction; rather, what was needed was some group that could improve coordination of the various U.S. space activities, including NASA and beyond.

* * *

National Academies Study: *Rationale and Goals of the U.S. Civil Space*

Gen. Lester Lyles

Gen. Lester Lyles said he was honored to chair the study, “America’s Future in Space: Aligning the Civil Space Program with National Needs.” Space, he said, played an important part in many aspects of national life; this perspective lay behind the National Academies’ interest in this study. The study’s task, he said, was to advise the nation on the key goals and critical issues in 21st century U.S. civil space policy — determine overarching goals; identify the obstacles to achieving those goals; and recommend actions to address unresolved matters. Gen. Lyles noted that the President of the National Academies had instructed the group not “to get down into the weeds,” but, rather, to offer the current Administration high-level strategic recommendations. He noted that “civil space” was broadly defined to include all non-military and non-intelligence related government space activities, including commercial space.

Gen. Lyles presented the committee’s overall conclusion: “That a preeminent U.S. civil space program with strengths and capabilities aligned for tackling widely acknowledged national challenges — environmental, economic, and strategic — is a national imperative today, and will continue to grow in importance in the future.” He added that strategic leadership required the nation to have “a civil space program whose breadth, competence, and level of accomplishment ensures that U.S. leadership is demonstrated, accepted, and welcomed.”

Gen. Lyles identified the foundational elements for such an effort: First, coordinated national strategies should be pursued in a better and more institutional way than at present. Second, a broadly engaged technical workforce, and that included DoD, was needed. Third, infrastructure needed to be effectively sized and structured. This, he said, did not mean altering the size or number of NASA Centers; rather, it meant ensuring opportunities for academic and commercial agencies to work in partnership. Fourth, a priority investment in technology and innovation was required. Gen. Lyles expressed the view that less effort was currently being directed to innovative technology investments than in the past.

Gen. Lyles presented the recommendations his study had produced. These included: addressing national imperatives; climate and environmental monitoring; scientific inquiry; advanced space technology; international cooperation; human spaceflight; and organizing to meet national challenges. [These recommendations were described in detail in his committee's National Academies report.]

Gen. Lyles noted that, early on, his group had intended to urge the President to re-constitute a National Space Council. Such a step, he said, had been endorsed in a 2008 study on national security and space management undertaken for the U.S. Senate. However, his committee did not make any recommendation on this, because the National Academies do not tell the President how to organize the government.

Dr. Owen Garriott said, given that the study lacked the formal sponsorship of an official body, how did Gen. Lyles foresee it would receive proper attention? Gen. Lyles said that while formal sponsorship was lacking, the Presidents of the National Academies had been active in promoting awareness of the study. Further, results would circulate through those groups with which the group had met, including the Office of Management and Budget [OMB], Congressional staff members, and a "long list" of Executive Branch personnel. He also noted that he would be meeting with the National Security Advisor, Gen. James Jones.

Gen. James Abrahamson said he was delighted by the emphasis Gen. Lyles placed on commercial space activities. He noted that impressive industries had been created out of NASA initiated activities. These, he said, had passed the market tests of investors, entrepreneurs and corporations. He said that one unrealized commercial possibility was the Navigation Satellite concept; this had remained a federal undertaking because its capabilities were so broadly useful to the federal government. He added that a "reasonably graceful" transition was being made into space transportation as a commercial enterprise. Gen. Abrahamson called attention to the importance of NASA technology research, urging that support be directed to how innovation could be transitioned into a commercial enterprise.

Gen. Lyles noted that his study was attempting to address this, in part, through discussions with economists. While space technology might not receive all the credit deserved, he believed the role of GPS—from navigation to the iPhone and elsewhere—was enormous; indeed, virtually everything that's involved in moving things rapidly depends on the timing aspect of GPS. GPS satellites, he added, underpinned the commerce of the world—a development, he noted, that could not have been foreseen when the technology was first developed.

Dr. Raymond Colladay said the commercial segment was critical to this discussion. He identified two issues. First, how could technology development support the nation's broader interests—he believed NASA was familiar with this perspective, but not always mindful of it. Second, in those cases in which NASA had taken the lead with commercial undertakings, he thought it was important that the agency know when to "get out of the way." At times, he said, an awkward transition period occurred during which NASA was both an enabler and a competitor.

Mr. Michael Montelongo commented that while institutional stakeholders needed to be mobilized, it was also important to widen the aperture to include the venture capital community.

* * *

Exploration and ad hoc Biomedical Committees

Lt. General James Abrahamson USAF (Ret)

Gen. James Abrahamson noted that while his committee was conducting various long-term reviews, he wished particularly to address the activities of the ad hoc biomedical committee. He reported that

on July 14, a biomedical fact finding session had been held, reviewing budget implications and options for biomedical activities. This included a broader look at probabilistic risk assessment, to be undertaken in collaboration with the Space Operations Committee. He noted that during the July 15 session, his committee had been briefed on NASA's use of various Earth analogs for lunar activities. The committee regarded these efforts as appropriate and well-planned, and urged that at some point they be extended to such human elements as diet, waste management, crew isolation, and communications.

Gen. Abrahamson also discussed lunar architecture requirements. Returning to the Moon, he said, was not a repeat of earlier efforts; rather, it was a reach into the unknown to operate on the Moon or, perhaps, on Mars. The activity, he said, entailed great uncertainties, including the possibility of accidents that requires creation of contingency operations and fallback plans. He considered this a very involved activity. Related to this, he reported on efforts to reinvigorate NASA medical programs. A competition had been held and the National Space Biomedical Research Institute had been selected. He noted that participation from outside groups helped to maintain competition within the program. Gen Abrahamson said this activity would not only permit NASA to undertake its exploration missions more effectively, but could bring significant benefits to medical practice on earth. He felt the current level of activity was impressive, given the small size of the management team.

* * *

Science Committee

Dr. Jack Burns, Chair

Dr. Jack Burns introduced the Science Committee's newest member, Dr. Roy Torbert, chair of the Heliophysics Subcommittee. Then, Dr. Burns identified four developments since the April 2009 meeting.

The first — which he termed very important — was the progress made between NASA and ESA [European Space Agency] in identifying interests and possible opportunities for collaborating on space science missions. Dr. Burns believed this engagement pointed toward important opportunities for significant international collaboration, such as on further robotic exploration and a future sample return mission to Mars, an undertaking he thought beyond the reach of a single nation. Second, he noted significant progress on the Astrophysics and Planetary decadal reviews. Third, he cited the “spectacular success” of the Hubble Space Telescope [HST] servicing mission. Fourth, he acknowledged new challenges with the Mars Science Laboratory [MSL].

Dr. Burns said the Science Committee believed that the Earth Science portfolio was too large in scope to be managed within Earth Sciences, or NASA; broader national coordination is needed. The Science Committee therefore reiterated its recommendation from the last meeting: “NASA should work with the Office of Science and Technology Policy [OSTP] and other agencies at the highest levels to define responsibilities and secure funding for Earth observations beyond those recommended by the Decadal Survey to advance Earth System Science.” Dr. Burns added that, given the current desire to further understand the climate, this is a good opportunity for NASA to take a leadership role in the area.

The following reports were made by Science Committee members:

Earth Science: *Dr. Byron Tapley*

Dr. Byron Tapley presented QuikSCAT data showing the decline in Arctic sea ice coverage. He noted that both the extent of coverage and the thickness of that ice were at issue. The data pointed to a 40 percent reduction, which suggested, he said, that much of the long-term ice had melted. Further work would add to understanding of that melting and the resultant impact on ocean circulation.

Dr. Tapley reported on the Foundational Missions of NASA's Earth Science Division, on replacement of the Orbiting Carbon Observatory, on the National Polar-orbiting Operational Environmental Satellite System [NPOESS], and on the current decadal survey. Dr. Tapley said he wished to add to the Council's previous recommendation that Dr. Burns had mentioned [above]:

“Extend bilateral cooperation with ESA to include Earth Science.”

International cooperation, he said, was occurring with France, Germany, Argentina and Japan; ESA, he said, as the major European space agency, was an appropriate body for collaboration. For the present, he said, work with ESA could focus more on discussion of possibilities rather than on specific plans.

Dr. Burns commented that ESA, like the United States, was not well organized for looking at climate. He believed NASA could demonstrate leadership in this area by identifying a national strategy and using that strategy as a framework for pursuing discussions with ESA.

Astrophysics: Dr. Michael Turner

Dr. Michael Turner reported that HST had received its “3 billion mile tune-up” – this had entailed five space walks over eleven days. The mission appeared to have been a full success; he believed the telescope could function for an additional ten years. Hubble, he reported, would continue to make breakthrough discoveries in planet finding, dark energy, black holes and information on planet/star formation. He quoted a statement from the Astrophysics Subcommittee which read, in part: “This last visit to Hubble shows NASA at its best.”

Dr. Turner reported on Herschel/Planck, which, he said, illustrated cooperation between NASA and ESA. He noted that the instruments involved had been cooled to 0.3 Kelvin, colder than any previous human-made detectors in space.

Dr. Turner reported that the Astrophysics “fleet” of satellites spanned the full electromagnetic spectrum. This “golden age” of space telescopes might prove short-lived, however, because while budgets were generous, they had declined. In the next decade, he said, \$2-\$4 billion would be available for new Astrophysics missions. Given that a single flagship telescope could cost \$1-\$4 billion, this would not finance many missions. New satellites would be deployed, he said, more slowly than older ones were retired. He believed recognition of this was needed to support realistic planning.

Dr. Turner noted that the Exo-Planet Analysis Group was in operation; this activity was important, he said, as in financially-constrained times one wanted the best possible advice.

Planetary Science: Dr. Brad Jolliff

Dr. Brad Jolliff described the current NASA Planetary Science program as “stunning.” He presented a mission timeline, noting that NASA science had missions from Mercury to Pluto. He reported that Cassini/Huygens had been able to monitor parts of Jupiter's moon, Titan, which had atmospheric characteristics similar to early Earth. He noted that the Mars Exploration Rovers [MERs] were still operating very well after five years. He reported that Lunar Reconnaissance Orbiter [LRO] was providing very high resolution data of the Moon.

Dr. Jolliff reported on the Lunar Exploration Advisory Group [LEAG], which had been tasked by the NAC to develop a lunar exploration roadmap. The challenge, he said, was to integrate elements relating to all stakeholders into this roadmap; he believed the LEAG would meet its summer deadline.

Dr. Thomas Jones asked when LRO would begin to provide information on volatiles in polar regions. Dr. Jolliff said this information would be available soon. Three separate instruments were involved;

results should be available by year's end. Dr. Jones asked Dr. Jolliff what he viewed as appropriate follow-up to this information. Dr. Jolliff offered his personal view that one would follow with surface measurements, which could be accomplished by a robotic mission.

Dr. John Logsdon asked if LRO would provide a view of the Apollo landing site. Dr. Jolliff said it would, but declined to say when. Dr. Gerald Kulcinski asked when molecular information might be available. Dr. Jolliff said such information might be available from the Lunar Crater Observation and Sensing Satellite [LCROSS], provided sufficient material could be gathered into the flume. Otherwise, such information would come from subsequent *in situ* measurements.

Mars Science Laboratory challenges: *Dr. Jack Burns*

Dr. Burns said discussion of the challenges facing MSL was important. The MSL launch date had been postponed from 2009 to 2011 because "the degree of technical readiness" had not been achieved. With that recognition, he said, an additional \$400 million had been provided to the project. He noted that a new program manager was in place, and a top-to-bottom assessment of technologies and instrumentation undertaken. This assessment had identified problems with the actuators; the replacement actuators required heating; this, in turn, would raise the general power drain. The power drain situation was worsened by the fact that one major instrument would require more power than originally anticipated. Dr. Burns stated it was cause for concern that such problems were revealed late in the program. The incremental costs of addressing the remaining technical issues, he said, had been assessed by the NASA Jet Propulsion Laboratory [JPL] and independent cost estimates as between \$15 million and \$115 million. Dr. Burns described MSL as "an ongoing concern." NASA Science Mission Directorate, he said, had acted appropriately: weekly status assessments were being made; a major management review would follow, and a "readiness to proceed" review was scheduled for fall 2009.

Dr. Burns said he believed the "ripple effects" of added cost on MSL would be substantial. He made the following recommendation:

"Recommend no allocation of additional funds for MSL beyond current level, pending planned reviews in fall 2009, and to document the lessons learned from MSL history relative to cost growth and technology issues for a large, complex mission."

Such lessons, Dr. Burns said, would be translated into a "white paper" and made public so they can be utilized by future mission planners. Col. Eileen Collins suggested that Dr. Burns' recommendation be restated as two separate recommendations. Dr. Burns welcomed the suggestion.

Dr. Kenneth Ford asked Dr. Burns to what extent he associated the MSL difficulties with the absence of a robust technology program at NASA. Dr. Burns said this was a major lesson learned. MSL requires major technological advances entailing several substantial technology R&D efforts, each being undertaken concurrently with spacecraft construction. There was general recognition, he said, that MSL involved too much technology risk in one project. This circumstance lent support to the argument for developing a robust technology program within NASA.

Heliophysics: *Dr. Roy Torbert*

Dr. Roy Torbert reported that the Sun had saluted the nation's birthday on July 4 by presenting the first evidence of new cycle sunspots. NASA's Heliophysics Division had been anxious for this cycle to begin, as it had multiple new assets in space to view them. He hoped at the next meeting to present new data from the Interstellar Boundary Explorer [IBEX], which will be able to view the Moon (and its interaction with the solar wind) when it came into its field of view.

Dr. Torbert reported that the Heliophysics Division had taken a new tack on its roadmap, soon to be published. Unlike other such documents, this roadmap created science targets rather than mission

architectures, thereby giving the Division additional flexibility. He reported that the NAC Science Committee was intrigued by this approach, which he felt others should consider.

Concluding Comments: Dr. Jack Burns

In conclusion, Dr. Jack Burns stated that NASA now has the largest number of science spacecraft up and running in its history. A number of them, however, would soon exhaust their lifespan. While new spacecraft were in view, these would not prevent a significant shortfall in space science assets. Dr. Burns presented a budget plot: in 2004, when the last decadal surveys were produced, the budget trajectory pointed to considerably higher funding than had occurred. Actual funding was 25-30 percent lower, producing a gap of \$2 billion per year since 2005. This aggregates to a \$10 billion shortfall by the end of the decade. He noted that while “we beat ourselves up a lot,” many issues NASA faced traced to that shortfall. One result of the lower funding, he said, was that the Astrophysics Division would “drop off a cliff” after 2015. While Astrophysics would have smaller explorer missions and a large flagship mission, the James Webb Space Telescope [JWST], the healthy balance of small-medium-large missions would be lost. Further, opportunities for researchers would be reduced. This, he said, would create instability, with no clear way to plan for either manpower or missions. Work was needed to create something more balanced. The problem, he said, was in part management instability; more significantly, it was a financial instability.

* * *

Human Capital Committee

Dr. Gerald Kulcinski, Chair

Intergovernmental Personnel Agreement Program

Dr. Gerald Kulcinski reported that the Intergovernmental Personnel Act [IPA] allowed persons from non-federal agencies to be assigned to federal agencies (and vice versa), provided the assignment was of mutual benefit; such assignments generally last two years. Currently, 62 IPAs were serving at NASA of which 46 were from universities. Dr. Kulcinski said that several years ago the Office of the Inspector General had reported that NASA had inadequate control over IPA expenditures; further, the prescribed cost sharing was not taking place and NASA reimbursement for indirect costs was improper. NASA had attempted to establish such cost sharing, based on the proportion of benefit each party received, with the host institution paying at least ten percent of the cost. The former, he said, had proven difficult to determine and the latter was a “non-starter” for universities. The resolution was that the universities could satisfy the ten percent requirement by counting their own indirect costs as a contribution. The Human Capital Committee, he said, had no objection to this new policy.

Lunar Exploration Roadmap

Dr. Kulcinski presented an approximate timeline for the return to the Moon and beyond that had been briefed by the Lunar Exploration Advisory Group to a joint session of the Science and Human Capital Committees. He urged that the Constellation astronauts be selected as soon as possible so they may be included in planning.

Dr. Thomas Jones noted that a new astronaut class had been chosen several weeks ago; however, perhaps only one or two of these individuals would be involved in planning categories. Dr. Kulcinski said a larger number would be preferred. Dr. Byron Tapley noted that ESA had also selected an astronaut class recently and inquired whether any thought had been given to creating an international astronaut community. Dr. Kulcinski said that was outside his jurisdiction. Dr. Jack Burns noted that discussions had occurred on what roles astronauts would serve, not only on the surface of the Moon but prior to any launch. Col. Eileen Collins noted that in the 1990s, the astronaut office created a core group of astronauts that were space-station trained. When mission managers selected crew members for a flight, they went to that pool and became the experts and specialists in the operation of the spacecraft. Dr. Kulcinski asked Col. Collins when such people should be on hand. Col. Collins

advised the sooner, the better. She noted that while engineers were assigned to the astronaut office, no scientists were currently assigned. Dr. Bradley Jolliff recalled a NAC recommendation from 2007; namely, that scientists and astronauts should work together for an extended period of time. Dr. Jones said the goal of getting astronauts involved with scientists had probably not been realized.

Strategic Communications

Dr. Kulcinski conveyed information the committee had received from NASA on its strategic communications. The Office of Communications Planning had defined strategic communication as “getting the right message, through the right media, to the right audience at the right time and with the right effect.” Dr. Kulcinski called attention to the NASA 50th anniversary lecture series, the Smithsonian Folklife festival, and provided data on communications with the public. He also noted that NASA was trying to raise awareness of the fact that it represented 0.4 percent of the federal budget; many people – including those in leadership groups – assume the figure is far higher.

NASA 2008 Human Capital Survey Results

Dr. Kulcinski reported results from the 2008 NASA Human Capital Survey, a detailed assessment undertaken by an outside body. He noted that NASA’s 2008 index score had been 71.7, an increase of 2.8 over 2006. He added that NASA was ranked as the third best government agency in which to work, up from fourth in the previous survey. Further, it ranked in the top three in nine of the ten “best-in-class” categories. He noted, however, that results varied considerably between NASA Centers. NASA’s Office of Human Capital Management, he said, was using the survey results to identify areas for improvement. The committee urged NASA to make continued use of the data, to benchmark individual Centers, and to compare the survey results with those of other federal agencies.

Analysis of Recent NASA Hiring Patterns

Dr. Kulcinski reported on the Office of Human Capital Management’s (OHCM) assessment of its hiring patterns. OHCM had reported to the committee that they had studied data between FY05 and FY09 to identify trends in the hiring of “freshouts” and Co-Ops. [NASA’s use of the term “freshouts” characterizes persons within three years of their most recent degree.] NASA’s full report of their study would be presented to the Human Capital Committee at its October meeting. The chief finding from the study thus far, he said, was that there is a strong pattern of NASA Centers hiring individuals from regional universities located in the same state as the NASA Center. Dr. Kulcinski showed center-by-center data that gave a state-by-state comparison.

Dr. Raymond Colladay said he would welcome aggregated data for all out-of-state hires so the share of in-state hiring at a given Center could be more readily identified. Mr. Michael Montelongo referenced earlier discussion about the need to bring the best people to NASA. Perhaps, he said, it was time to seriously consider creation of the equivalent of a Service Academy for NASA. He noted interest elsewhere in creating a U.S. Public Service Academy, where undergraduates would be educated at taxpayer expense, in exchange for serving in a public capacity for some period after graduation. Such discussions, he noted, emphasized the liberal arts; he believed they could be extended to the STEM [science, technology, engineering and math] disciplines.

Dr. Jack Burns suggested that the pattern of in-state hiring might reflect the fact that persons from many states attended a particular university because a NASA Co-Op program operated there. Dr. Kulcinski said that might be true for Co-Ops; however, the larger numbers involved were freshouts. Dr. Burns noted that the data was for university attended, not for state of origin. Dr. James Milgram commented that, in general, new hires were not coming from the top national universities. Dr. Kulcinski said the Human Capital Committee’s central concern was whether NASA was availing itself of the nation’s full talent pool. He reported that NASA Center directors had been shown the data and had been quite surprised by the findings.

Col. Eileen Collins said the issue needed continued attention: Do NASA Centers recruit? Should they do so? Dr. Kulcinski said he did not see the data as an indictment: Ph.D. skills were often very narrow and only a few institutions in the country might have programs in a given area. Dr. Kenneth Ford said this was opportunity to do things better. He noted, however, that at present the NASA hiring market was limited: commonly, Centers were hiring replacement personnel, who tended to be more senior.

* * *

Review of U.S. Human Space Flight Plans Committee [“Augustine Committee”]

Progress and Plans

Mr. Norman Augustine

Mr. Norman Augustine addressed the NAC session by speakerphone.

Mr. Augustine stressed that his committee was charged only with looking at the future of the human spaceflight program, not at other aspects of NASA operation. At present, he had no answers to give or outcomes to predict. He stated that, having served on many advisory groups, this one was extraordinarily diligent. He noted that the Committee had only 90 days to work, so that its task would be completed within the current budget cycle. Mr. Augustine reported three boundary conditions that he was given: first, that the Committee would deliver options rather than recommendations; second, that it must respect current budget limits; and third, that the space shuttle would cease operation in 2010. However, he said he had reached agreement to revise a few of the terms. Mr. Augustine stated that if the Committee thought it was advisable, it would also present options beyond the current budget ; potentially provide an option to extend the shuttle; and submit an interim report (versus final) at the end of the 90-days.

Mr. Augustine identified two issues immediately before his Committee – the space shuttle and the ISS. First, he noted that only seven launches remained and that a gap in U.S. furnished human access to space would follow. Secondly, what should the future of the ISS be after 2016? These questions were complicated by a fundamental conflict: NASA wished to do new things; however, if the budget did not expand, new things could only be done by cutting back elsewhere. He noted that many in Congress were critical of the fact that the U.S. would be dependent on Russia for ferrying astronauts to ISS; at the same time, however, NASA is under considerable pressure to act collaboratively with other nations.

Mr. Augustine noted that the Committee had retained the Aerospace Corporation to provide independent checks on cost issues and other matters. This, he said, did not suggest a lack of trust in NASA; rather, it reflected the value of getting a second opinion. Mr. Augustine said the Committee had striven to draw in public input – indeed, he said nothing on which he had worked had drawn so much public interest.

Mr. Augustine described the Committee’s five subcommittees: The first, instead of addressing the question, “Where is it you want to go?” will pose the question, “Why do you want to do it?” That is, “Was the intention to pursue engineering and science? Build an international alliance? Inspire children?” The second will address the question of lower cost ways of reaching LEO. The third will deal with the ISS and the space shuttle. The fourth will deal with international aspects. The fifth will review internal matters, such as workforce, DoD relationships and budget implications.

Gen. James Abrahamson said that he believed the nation at present had the best NASA he had ever seen. Whatever decisions the Obama administration might make, he said — in terms of a motivated workforce; the proper procedures, processes and attention to costs; and the proper attention to

quantifying risks — a terrific NASA team existed to carry out those decisions. Mr. Augustine said he shared that view.

Col. Eileen Collins reported that Mr. Augustine had mentioned all the issues on which the Space Operations Committee was working. She wished to repeat one: that is, that the NASA employees with which she had worked were superior and responsive to recommendations. Further, individuals in the space program were passionate not only about their jobs but about exploration generally. She added that when she's spoken around the country and told people that the space shuttle was to be retired, they were shocked. More generally, she was surprised by how many educated people were unaware of what NASA was doing. Mr. Augustine agreed with Col. Collins' comments. He cited a similar experience of speaking to a group that he would have considered knowledgeable; yet, they, too, had been shocked to learn the space shuttle was being retired.

Dr. Raymond Colladay asked whether the Committee would review the status and adequacy of NASA's technology base. Mr. Augustine said this had been an issue. While not wishing to predict the outcome, he said the Committee's general view was that the technology base had been neglected, with technology work being done within missions rather than prior to missions. Dr. Colladay noted that because developing advanced technology was a long-term enterprise, it tended to be sacrificed to meet short-term financial needs. He believed the technology base had been depleted and urged recognition of the importance of replenishing it.

Dr. Jack Burns noted that science was outside the charge to the Committee. Still, he asked if the Committee was receiving input from the science community. Mr. Augustine said the Committee viewed science as highly important and noted that two members of the Committee were fully legitimate scientists. On lunar science, he noted a division: one group claimed lunar science offered very exciting possibilities, whereas, a second group asserted there was little point in returning to the moon — money should be spent elsewhere. The latter group, he said, was more vocal. This presented a dilemma.

Dr. Owen Garriott noted that the Committee was to identify options rather than make recommendations. Given, however, the tendency to "parse" every word in a document, how can people be prevented from interpreting options as recommendations? Mr. Augustine termed this "the sixty-four dollar question." The Committee's goal — and the measure by which it would be judged — would be its ability to present doable options in factual, balanced and unbiased terms. He saw some problems with this. He anticipated being asked at the White House, or by the media: "What do you think we should do?" He said that he has three options — he could say he didn't know; he could say he knew but wouldn't say; or he could say he was speaking only for himself, not the Committee. Of these, he thought the third was the least bad. In any case, he doubted the Committee, as a body, would publicly express a preference.

Dr. Gerald Kulcinski asked how NASA could attract the "best and brightest." He identified a perceived conflict — there was pressure to work more with international partners; at the same time, there was a proscription against hiring non-U.S. graduates. He noted that at present 60 percent of advanced science and technology degrees were going to non-U.S. citizens. Mr. Augustine termed this an important question. The Committee, he said, would look at manpower questions both in terms of jobs for Americans and, more important, for preserving the technical base NASA required. He pointed to a broader problem: if he was a 21-year old, would he really commit to working on a project that would take two decades to reach fruition, during which time five Presidents and ten Congresses would each have a chance to cancel it?

Dr. Stephen 'Pat' Condon asked who would evaluate the Committee's reported options? Mr. Augustine said he believed the decision would be made by the President. He believed this would be the case because of the likely implications: namely, because relations with allies were involved and

— his own view — because the three states most affected by the employment issues were Florida, Texas and California.

The question of minority reports was raised. Mr. Augustine said he believed minority reports significantly weakened the impact of a report. Only in the case of a small sub-group disagreeing very strongly would he tolerate a minority report.

Dr. Bradley Jolliff made reference to the Tempe, Arizona workshop on lunar architecture held several years ago. It had been clear, he said, that lunar exploration was not being undertaken for the sake of science; rather, the question had been to examine what science could be done in connection with that exploration. He was pleased to hear that the Committee was looking at science on the moon; science from the moon; integrating commerce; and working with international partners. How, he asked, would all this be placed into an integrated set of exploration objectives? Mr. Augustine said he believed that one challenge the human space program had faced over time was that it often lacked a *raison d'être* for science. Apollo, he said, had been largely undertaken as a matter of national prestige. He believed a broader assessment was required.

Dr. Thomas Jones asked if the Committee would review NASA funding over time, relative to other domestic priorities. Mr. Augustine said NASA funding levels would be reviewed, but the Committee would not make comparisons with other government programs.

* * *

Audit and Finance Committee

Mr. Ted McPherson (Substituting for Mr. Robert Hanisee, Chair)

NASA 2009 Financial Audit: *Mr. Ted McPherson*

Mr. Ted McPherson reported that the NASA 2009 financial audit was on schedule. He said that Ernst & Young was “cautiously optimistic” that it would be able to rely on NASA internal controls for line items other than property, plant, and equipment and unfunded environmental liabilities. He believed the auditor’s opinion might be available by late October.

Mr. McPherson identified two key accounting issues to be resolved. The first, he said, related to accounting for NASA legacy assets, especially the ISS and the space shuttle (combined, these represent \$19 billion of NASA’s \$21.6 billion in property, plant and equipment). He noted a possible solution: the Federal Accounting Standards Board may allow NASA to estimate the original transaction costs and depreciation, rather than requiring the agency to go back and reconstruct records. Those estimates, he said, might be as simple as reporting the appropriation made. He believed that this possible “ingestion of common sense” could break the logjam on this issue, which, he noted, also affected DoD. Mr. McPherson noted that the approach being considered had first been discussed by the NAC three years ago. In the meantime, he reported that all new equipment – e.g. Constellation – was being accounted for under proper procedures.

The second issue, he reported, was that NASA had an estimated \$1 billion in unfunded environmental liabilities. He reported as good news that 50 of the 130 sites in question were now in remediation, which means they were in a position to obtain estimates prepared by engineers. Mr. McPherson said it was now the task of NASA staff in various offices to prepare an overall estimate satisfactory to Ernst & Young. He believed the severity and scope of the problems involved had been considerably whittled down. On other accounting matters, he identified the closing out of procurement contracts and remaining work on intra-government accounting. He noted that the list of outstanding matters had declined.

Mr. McPherson said committee's assessment was that there had been vast improvement in the quality and integrity of NASA financial data. The staffing of the Office of Chief Financial Officer was now satisfactory; further, he said, improved working relationships had unquestionably been established by NASA accounting staff with the Office of the Inspector General and Ernst & Young.

Mr. McPherson presented to the NAC two testimonies relevant to the topic. The first was from committee chair Robert Hanisee, delivered to Subcommittee on Space and Aeronautics of the House Committee on Science and Technology. The second testimony was from Ronald Spoehel, NASA Chief Financial Officer, for a hearing before the Subcommittee on Government, Management, Organization and Procurement of the House Committee on Oversight and Government Reform. He described these as good and direct summaries.

The NAC Chair invited comments from Mr. Ron Spoehel, who was present. Mr. Spoehel commented that the formal questions from the Subcommittee that he had received prior to presenting his testimony related to structure and processes, such as: Does NASA have the right data systems? Was NASA's SAP accounting system working properly? He noted that no additional questions had been posed during the hearing, which adjourned due to a floor vote of the House.

Managing Risk and Uncertainty: Mr. Ted McPherson

Mr. Ted McPherson said the general problem was to deal effectively with project cost estimates made early in a mission. The difficulty, he said, was inherent: engineering requirements are complex. Recently, the NASA's Office of the Chief Finance Officer had developed a very effective "phasing" plan to improve management of the rate of spending on projects.

On another matter, he reported that NASA had greatly reduced its year-end un-obligated carryover funds. These, which had been running in excess of \$2 billion as recently as FY07, had been reduced in FY08 to \$500 million and should meet the FY09 target of \$350 million. This, he noted, was an example of the competency that was now in place to support the efforts of the NASA Administrator.

American Recovery and Reinvestment ['Stimulus'] Act: Mr. Michael Montelongo

Mr. Michael Montelongo reported that NASA would be receiving \$1 billion in funds under the American Recovery and Reinvestment ['Stimulus'] Act. He believed NASA was far better equipped today to deal with such funding now than when the NAC first began meeting on these issues several years ago; indeed, he believed NASA was more effectively organized for this purpose than most federal agencies. This money, he noted, was to be spent over a two-year period. He added that the 'stimulus' funding was an enterprise-managed activity, carrying with it unprecedented transparency and accountability. He reported that on May 15, 2009, NASA had delivered to OMB the proposed use for these funds, agency-wide and through five program plans. These included: Aeronautics Research - \$150 million; Astrophysics - \$75 million; Constellation Systems - \$400 million; Earth Science - \$325 million; Institutional Investments - \$50 million.

Audit & Finance Committee Recommendation: Mr. Ted McPherson

"The National Aeronautics and Space Administration's Advisory Council recommends that the new Administrator of NASA continue placing the high priority on effective financial management, accounting, and stewardship for NASA resources that have led to the valuable advances made in recent years in these matters at NASA."

* * *

Space Operations Committee

Col. Eileen Collins

Col. Eileen Collins previewed her committee's presentation that would be briefed by her committee members. She summarized second quarter 2009 highlights; reported that the FY10 budget was "workable, but tight" with "minimally sufficient program reserves;" called attention to the successful, recent Hubble servicing mission; and noted that the six-member ISS crew included astronauts from five nations.

Dr. John Logsdon asked if sufficient facilities existed for astronaut training. Col. Collins said there was not a facilities issue that she was aware of, however, in the past, there had been issues of having sufficient instructors to work with the robotics training.

Space Operations FY10 Budget: *Dr. Stephen 'Pat' Condon*

Dr. Condon said the Space Operations Mission Directorate was implementing programs as planned and within budget. The FY10 budget request was before Congress – if approved, it would provide the resources to safely and reliably "fly out" the space shuttle and complete the ISS. Senate and House committees had completed their mark-ups of the bill; the conference committee had yet to meet. The budget was very tight: slight reserves may exist, but there is certainly no fat. He regarded funding stability as critically important as the space shuttle close-down proceeded. Dr. Condon called attention to the shuttle budget lines for FY10 [\$3.157 billion] and FY11 [\$382.8 million]. Congress, he said, had given NASA the option to fly the shuttle through the end of calendar year 2010, however, funding stopped at the end of the fiscal year. Dr. Condon presented the manifest for the remaining space shuttle flights.

Gen. James Abrahamson expressed surprise at the budget for "other ISS operations" [given as \$2.267 billion for FY10; \$2.548 billion for FY11]. Col. Collins said the major cost was for operations of the ISS; these included astronaut services and the charges made by Russia for ferrying U.S. crew members. Ms. Nancy Ann Budden asked if any finding made by the Augustine Committee might significantly change this budget. Col. Collins said that while changes were possible, the plan had been built independently of the Augustine Committee. She believed the Augustine report would carry a lead time beyond the budget years she was presenting. Col. Collins noted that the manifest had been presented at the April 2009 meeting. The six launches scheduled for 2010 represented a tight and robust schedule; she believed it was doable assuming no unforeseen events.

Orion Recovery System: *Dr. Owen Garriott*

Dr. Garriott reported that the committee had been briefed on the Orion recovery system by NASA's Orion project. He stated that the briefers favored a water landing when returning from orbit. Dr. Garriott noted that it appeared that this was largely based on "weight on parachutes" and danger to the life of the crew resulting from the tumbling of a land landing. The ability to lift the mass with Ares I was not a deciding factor for either option. The project's assessment seemed to show that tumbling when hitting the ground was a serious risk to life, which approximately doubled the overall risk at return.

Dr. Garriott observed that the Russians have been returning in the Soyuz in this manner for four decades. He acknowledged that indeed, land landings can be a bit rough on the crew, but that the Space Operations Committee believes there's a possibility that it may be safer. He reported that no crew loss of life has ever occurred (perhaps even a serious injury) due to tumbling upon hitting the ground even though tumbling is expected at every reentry and may well have occurred at every reentry for decades.

Dr. Garriott called attention to the Skylab Medical Operations Summit, January 2008. He reported that the astronauts (five) and flight surgeon panelists were the only group with experience in water

landings; almost all of these participants preferred land landings. [The Proceedings of this two day meeting are now available.] He cited an additional factor in deciding whether to return from orbit with a land or water landing: space modules are expensive – land landings afforded an 82 percent re-use rate; water landings only a 42 percent re-use. Based on this, the Space Operations Committee suggested that NASA further review the recommendation for water landing.

Orion and Constellation Vehicles: *Dr. Thomas Jones*

Dr. Thomas Jones raised the prospect of using Constellation hardware for other than lunar missions; specifically, for human missions to Near Earth Objects [NEOs]. NEO missions, he said, would expand human exploration of space beyond lunar orbit. Such missions might take 90 to 150 days; would permit exploration of a different class of objects; and would provide a stepping stone to Mars. He noted that NEO missions would require additional supplies for the astronauts, additional propulsion capability, and some means of radiation protection against solar flares. He stated that human missions to NEOs would permit return of an intelligently-collected set of samples; would provide the civil engineering knowledge needed to nudge a threatening NEO out of an earthward path; and would provide biomedical understanding of how humans can survive in deep space. Finally, he said, such missions could inspire and could help sustain public and Congressional support for space activities. In conclusion, he believed a human mission to a NEO was “tentatively” possible. This, he said, meant that the vehicle now being designed for the next 30 years could be used beyond the Moon.

Dr. Kenneth Ford said that in developing the next space transportation architecture, the nation would be well-served by the development of a flexible transportation system that afforded access to the widest range of likely target destinations. He then asked if the possibility of depositing a “leave-behind” set of science instruments on a NEO had been investigated. Dr. Jones noted that Orion had an instrument bed; packages stored there could be installed by the crew for leave-behind operation. He noted that an astronaut could undertake pilot extraction of samples before establishing the leave-behind capability.

Ms. Nancy Ann Budden asked about possible use of emplaced astronomic instruments. Dr. Jones said that because asteroids tumble very rapidly, any instrument placed there might not face the part of the sky one wished to see. Ms. Budden asked whether, given the extremely low gravity of NEOs, some kind of tethering might be required, thereby forcing spacecraft modifications. Dr. Jones said NASA had experience with remaining on a surface with such small gravity. One advantage of human explorers, he said, was that they could try a variety of anchoring schemes.

Dr. Jack Burns said NEOs offered excitement as an additional human destination; he thought further study was worthwhile. He noted, however, that nearby NEOs were only 100 to 150 meters in diameter – reaching them would be less like landing than like docking. He was uncertain how this would be accomplished: getting out of the capsule would be challenging, as there would be no air lock. He believed that if one were to start from scratch to design a vehicle to go to asteroids, it would look rather different from what had been presented. Dr. Jones acknowledged the challenges, but said he believed NASA had the required tools to address them. An airlock could be built into a collapsible living space, he said, with the pilot flying a slow approach to permit use of a rigid landing system.

Aerospace Safety Advisory Panel: *Mr. Jay Green*

Mr. Jay Green reported on his attendance at the Aerospace Safety Advisory Panel, April 29-30, at the Johnson Space Center in Texas. He termed the meeting very useful; most issues discussed related to Constellation.

NASA Space Flight Human System Standards (Volumes 1 & 2) & Human Integration Design Handbook (HIDH): *Col. Eileen Collins*

Col. Eileen Collins said Volumes 1 and 2 of the Human Systems Standards established standards for human factors, habitability, environmental health and crew health. The committee had received a

briefing on this topic in April 2008, and this was an update. The purpose of the standards is to ensure the developers of a system write design requirements tailored for their system, and that the end product meets that standard. The HIDH helps with system-specific design requirements. One question posed, she said, was how these standards might apply to developers of commercial human spacecraft.

Col. Collins noted that her group had no formal recommendations to make at this meeting. She reported that at its next meeting, the Space Operations Committee would review the implications of the Augustine Report; consider the Human/Machine Interface of Orion for both ISS and Lunar missions; the human factors work with JSC's Mission Operations Directorate; Orion Thermal Protection System (with the Exploration Committee); follow up on Constellation water vs. land landings; and review work at Ames Research Center on vehicle handling qualities for Moon/Mars landings.

* * *

Aeronautics Committee

Dr. Raymond Colladay (Substituting for Gen. Les Lyles, Chair)

Dr. Raymond Colladay noted that this was the first meeting of the Aeronautics Committee with its expanded complement of Ms. Marion Blakey and Mr. Pres Henne. He reported that the Aeronautics Research Missions Directorate [ARMD] had received \$150 million in Recovery Act ['Stimulus'] funds. The Aeronautics Committee wanted to be assured that the required conditions for this expenditure would be met and that the funds could be obligated in the allotted time; the committee had very high confidence that they would be. Dr. Colladay noted that one-third of this money would go to "shovel ready" facility upgrade and maintenance projects, two of which he described as reliability improvements for the Unitary Plan Wind Tunnel Air Compression System at Ames Research Center and a new refrigeration system for the Icing Research Tunnel at Glenn Research Center. These projects, he said, could be completed within the two-year time frame and, therefore, would not leave NASA with partially completed projects requiring agency funds to finish.

Dr. Colladay said his committee understood the importance of nurturing technology development and of the importance of stability of investments. The committee, he said, had focused on two technology issues: relevance and technology transition. Regarding the first, he believed that NASA aeronautics research needed to get close to its customers to understand their requirements. Second, he stressed the importance of very careful management of technology transition. He noted that while one did not always fully control events, one could create an environment that enhanced smooth transitions.

Dr. Colladay presented his committee's recommendation:

"The NAC is encouraged by the ongoing assessment of advanced technology development in the agency. We look forward to a report on the 'Innovation and Technology Initiative' addressing increased emphasis in this important area. We recommend that the NAC consider the results of this study at the next Council meeting."

Dr. Jack Burns observed that this statement read more like an observation than a recommendation. Was this the recommendation being made to the Council? Dr. Colladay said it was. Dr. Kenneth Ford expressed the view that stability — including stability of both technical programs and human resources — might be the most important determinant of what NASA could achieve in the next decade. He explained that instability in programs and plans have in the past often led to dramatic losses of the most capable scientists and engineers. Dr. Ford particularly emphasized the importance of stable technology programs, because these longer-term but critically important activities have often served as the "bank" for other more near-term budgetary needs.

Dr. Colladay called attention to a February 2009 NAC recommendation: “Convene workshop to provide external community input to NASA’s formulation of the system-level program on Environmentally-Responsible Aviation (ERA).” He noted that a provision for this program, focusing on systems-level research, had been included in the FY10 budget. An important part of the recommendation had been that persons from outside NASA be involved in providing input. He noted subsequent to that Council recommendation, a meeting of experts had been held in May 2009; the Aeronautics and Space Engineering Board [ASEB] of the National Academies had been judged the most convenient venue.

Dr. Colladay said the Aeronautics Committee had reviewed the results of this experts’ session, and was satisfied that the Council’s February 2009 recommendation had been met. Further, the committee believed the feedback received had improved NASA’s program content; a summary of that feedback would also be delivered to the meeting participants. He noted that the ERA program was an exercise in systems-level research, an area that had received explicit endorsement from OMB and Congress. The effort would take research results on noise, emissions, fuel efficiency and other technology from foundational research and evaluate them in a real environment. He noted that the experts’ meeting had also addressed how the technology of airspace systems would meet the next generation requirements of the Federal Aviation Administration [FAA]. He believed constant attention from both NASA and the FAA was needed to ensure the smoothest possible handoff from developers to users.

As the focus of the Aeronautics Committee’s next meeting, Dr. Colladay said, the committee would visit the Air Force Research Lab (AFRL) to learn more about the Applied Technology Council’s approach to technology transition; would review the status of those transition teams he had identified; and would receive an update on activities related to ERA.

* * *

Meeting Close:

Dr. Kenneth Ford, Chair

Dr. Kenneth Ford expressed his thanks to all participants. He officially welcomed and thanked the four new NAC members — Dr. Roy Torbert, Ms. Nancy Ann Budden, Mr. Pres Henne and Ms. Marion Blakey — for their willingness to serve. He also expressed appreciation for Dr. Donald Fraser and Adm. Benjamin Montoya who had served the Council well and whose terms of service ended since the Council meeting in April.

Dr. Ford noted that three formal recommendations had been presented and would be reviewed further. He anticipated the recommendations would be submitted to NASA largely as proposed.

Dr. Ford announced that the next NAC meeting would be held on October 27-29, 2009 at Ames Research Center.

The meeting was adjourned Thursday, July 16, at 3:05 p.m.

Appendix A: NASA Advisory Council Member Attendance Roster

Role/Group	NASA Advisory Council Members
Chair	<ul style="list-style-type: none"> • Hon. Kenneth M. Ford, Ph.D., Founder and Director, Florida Institute for Human and Machine Cognition (IHMC)
Aeronautics Committee	<ul style="list-style-type: none"> • Chair: General Lester L. Lyles, USAF (Ret.), Consultant, The Lyles Group • Ms. Marion Blakey, Chief Executive Officer, Aerospace Industries Association • Dr. Eugene E. Covert, T. Wilson Professor of Aeronautics (Emeritus), Department of Aeronautics and Astronautics, Massachusetts Institute of Technology • Mr. Preston A. Henne, Senior Vice President of Programs, Engineering and Test, Gulfstream Aerospace Corporation • Dr. Ilan Kroo, Professor, Aeronautics and Astronautics, Stanford University • Dr. John Sullivan, Professor, Aeronautics and Astronautics, and Director, Center for Advanced Manufacturing, Purdue University
Audit and Finance Committee	<ul style="list-style-type: none"> • Chair Acting: Hon. Edward R. “Ted” McPherson, Chief Executive Officer, InterSolve Group, Inc. • Hon. Michael Montelongo, Senior Vice President, Strategic Marketing, Sodexho, Inc. • Dr. Howard J. Stanislawski, Sidley Austin LLP
Exploration Committee	<ul style="list-style-type: none"> • Chair: Lieutenant General James A. Abrahamson, USAF (Ret.) • Ms. Nancy Ann Budden, Director for Special Operations Technology, Office of the Secretary of Defense • Dr. John M. Logsdon, Charles A. Lindbergh Chair in Aerospace History, National Air and Space Museum, Smithsonian Institution
Human Capital Committee	<ul style="list-style-type: none"> • Chair: Dr. Gerald L. Kulcinski, Associate Dean for Research, College of Engineering, University of Wisconsin-Madison • Dr. Lucy F. Fortson, Vice President for Research, Adler Planetarium and Astronomy Museum (Chicago) • Dr. R. James Milgram, Professor, Department of Mathematics, Stanford University
Science Committee	<ul style="list-style-type: none"> • Chair: Dr. Jack O. Burns, Professor, Department of Astrophysical and Planetary Sciences, University of Colorado; Vice President (Emeritus), Academic Affairs and Research, University of Colorado System • Dr. Bradley L. Jolliff, Research Associate Professor, Department of Earth and Planetary Sciences, Washington University (St. Louis) • Dr. Byron D. Tapley, Director, Center for Space Research, and Professor, Aerospace Engineering, University of Texas at Austin • Dr. Roy B. Torbert, Dean of College of Engineering and Physical Sciences, University of New Hampshire • Dr. Michael Turner, Bruce V. and Diana M. Rauner Distinguished Service Professor, The University of Chicago
Space Operations Committee	<ul style="list-style-type: none"> • Chair: Colonel Eileen M. Collins, USAF (Ret.), NASA Shuttle Pilot and Commander (Ret.), Aerospace Consultant, President of Space Presentations, LLC • General Stephen P. “Pat” Condon, Ph.D., Aerospace Consultant • Dr. Owen K. Garriott, NASA Skylab and Spacelab Astronaut (Ret.), Adjunct Professor, Department of Biological Sciences, University of Alabama in Huntsville; • Mr. Jay H. Greene, Aerospace Engineer • Dr. Thomas D. Jones, USAF (Ret.), NASA Shuttle Astronaut (Ret.), Consultant

Ex Officio	<ul style="list-style-type: none"> • Dr. Raymond S. Colladay, Chair, Aeronautics and Space Engineering Board, National Academies
<i>Not Attending</i>	<ul style="list-style-type: none"> • Mr. Robert M. Hanisee, CFA; Managing Director, Trust Company of the West • Captain Frederick H. “Rick” Hauck, USN (Ret.), NASA Shuttle Pilot and Commander (Ret.) • Dr. Stephen I. Katz, M.D., Ph.D., Director, National Institute of Arthritis and Musculoskeletal and Skin Diseases • Dr. Charles F. Kennel, Chair, Space Studies Board, National Academies; Director, Scripps Institute of Oceanography • Dr. Alexander H. Levis, Professor, Head of the System Architectures Laboratory, Volgenau School of Information Technology and Engineering, George Mason University • Dr. David Longnecker, M.D., Chair, Committee on Aerospace Medicine and the Medicine of Extreme Environments, Institute of Medicine, National Academies • Dr. Ioannis Miaoulis, President and Director, Museum of Science (Boston) • Dr. Mark S. Robinson, Professor, School of Earth and Space Exploration, Arizona State University

Appendix B: Meeting Attendees

Doug Cooke	NASA
Regina Dull	NASA
Dan Dumbacher	NASA
Jens Feeley	NASA
Elliott Johnson	NASA
Joyce McDevitt	NASA
Richard McGinnis	NASA
Merle McKay	NASA
Lee Olson	NASA
Louis Ostrach	NASA
Thomas Paine	NASA
Neil R. Pellis	NASA
Michael Salamon	NASA
Chris Scolese	NASA
Jaiwon Shin	NASA
Ron Spoehel	NASA
Michael Braukus	NASA
Cindy Stein	NASA
Andrew Barber	AIA
Bill Beckman	Boeing
Linda Billings	GWU
Bryon Callan	Perella Weinberg Partners
Andrea Dickmann	ESA
Charles Devine	HIAA/member
Brian Dewhurst	NRC
Walt Faulconer	John Hopkins APL
Nancy F. Ford	
Dean Gissentanner	GE
Eric Hand	<i>Nature</i>
Lynn Heninger	ATK
Carol Lane	Ball Aerospace
Jason Layman	
David McCreary	CMC
Shawn Neville	Hearst TV
Patrick O’Gara	Hearst TV
Sebastian O’Malley	
Aaron Oesterle	PoliSpace
Marcia Smith	SpacePolicyOnline.com
Bill Woolman	University of Minnesota
Keith Cowing	nasawatch.com
Four illegible	